The COVID-19 Pandemic and Mental Health: Disentangling Crucial Channels

Bettina Siflinger [1]
Michaela Paffenholz [2]
Sebastian Seitz [3]
Moritz Mendel [4]
Hans-Martin von Gaudecker [5]

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[1] Department of Econometrics and OR, Tilburg University, The Netherlands
[2] Center for Doctoral Studies in Economics, University of Mannheim, Germany
[3] Center for Doctoral Studies in Economics, University of Mannheim, Germany
[4] Bonn Graduate School of Economics, Bonn, Germany
[5] University of Bonn and IZA, Germany

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Bettina Siflinger [α], Michaela Paffenholz [β], Sebastian Seitz [β], Moritz Mendel [γ], Hans-Martin von Gaudecker [δ,ι]

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Abstract

Since the start of the CoViD-19 pandemic, a major source of concern has been its effect on mental health. Using pre-pandemic information and five customized questionnaires in the Dutch LISS panel, we investigate how mental health in the working population has evolved along with the most prominent risk factors associated with the pandemic. Overall, mental health decreased sharply with the onset of the first lockdown but recovered fairly quickly. In December 2020, levels of mental health are comparable to those in November 2019. We show that perceived risk of infection, labor market uncertainty, and emotional loneliness are all associated with worsening mental health. Both the initial drop and subsequent recovery are larger for parents of children below the age of 12. Among parents, the patterns are particularly pronounced for fathers if they shoulder the bulk of additional care. Mothers' mental health takes a particularly steep hit if they work from home and their partner is designated to take care during the additional hours.

1   Introduction

Starting in early 2020, the CoViD-19 pandemic and policy measures to slow its spread have upended the lives of billions of people. From early on, researchers and practitioners have been pointing towards possible adverse effects on population mental health through a variety of channels. Some of the most prominent pathways identified by prior literature include worries about and occurrence of the health effects of contracting the virus (e.g., Hollingue et al., 2020; Kämpfen et al., 2020); anxiety about job and income losses in the wake of the global recession caused by the pandemic (e.g. Davillas and Jones, 2021; Kämpfen et al., 2020; Witteveen and Velthorst, 2020); increased stress in families with children affected by closures of schools and daycare, especially when parents need to meet the requirements of their jobs and the needs of their children at the same time (Etheridge and Spantig, 2020; Zamarro and Prados, 2021); and increased loneliness through the loss of social contacts (Etheridge and Spantig, 2020).

We add to the literature on the early evidence on the pandemic in a variety of ways. First, except for some studies in the U.K. (e.g., Davillas and Jones, 2021; Etheridge and Spantig, 2020) and the U.S. (e.g. Kämpfen et al., 2020; Zamarro and Prados, 2021), few papers have been able to exploit probability samples with pre-pandemic information on mental health at the individual level. However, the response to the first wave of the pandemic in both of these countries was late and arguably not very efficient in containing the spread of the virus. Furthermore, the accompanying socio-economic relief measures were of much smaller magnitude than in many other countries. In contrast, countries like Germany, the Netherlands, or most Scandinavian countries, all took rather efficient measures against the first wave of the SARS-CoV-2 pandemic. Schools and daycare centers were closed and so were many customer-facing businesses. However, there was no general curfew, in contrast to many Southern European countries. At the same time, the well-developed welfare systems cushioned the socio-economic consequences. In this study, we consider the case of the Netherlands. In particular, we use data from the LISS panel, an Online panel based on a probability sample of the Dutch population.

Besides widening the geographic scope of studies by adding a prototypical country from North-Western Europe, we also expand in the time dimension by covering the entire year 2020. Our pre-pandemic information stems from November 2019 when the five-item Mental Health Inventory

(MHI-5) was assessed as part of the annual LISS questionnaire on health. We then have comparable measures from the first two weeks of the spring lockdown in March 2020, from May, June, September, and December. The summer was characterized by low infection rates and a fairly normal life; gatherings of large groups being the exception. However, cases increased rapidly again during September. By December, the Netherlands had been in another lockdown for several months. The temporal structure allows us to assess the mental health impact of the pandemic beyond the initial lockdown period.

Finally, we can exploit customized data that allows us to consider the above-mentioned channels jointly. They show very distinct temporal patterns, which allows us to disentangle them in a series of fixed effects regressions. We focus on the working population because we expect very different ways of how the pandemic would impact the mental health of older people.

Our results show that on average, mental health takes a very substantial drop during the period of high uncertainty early in the first lockdown. These mean values recover quickly before dropping again towards the end of the year. MHI-5 scores for December 2020 are very similar to values in November 2019. For the March-December period, there thus is a clear hump-shaped pattern. Mean levels of psychological distress are higher in women, a result that is well documented in the literature (e.g., Kessler et al., 1993; Van de Velde et al., 2010) and during the CoViD-19 pandemic for other countries (e.g., Etheridge and Spantig, 2020 or Davillas and Jones, 2021 for the U.K., Pedraza et al., 2020 for several countries). MHI-5 scores by gender evolve almost in parallel over the period under study, which cautions against the interpretation of regressions in levels as measuring the impact of the pandemic.

Beneath the averages, there is substantial heterogeneity across genders and the four channels that we consider. Mental health falls in perceived infection risk, maybe more so for women. On the other hand, the effects of labor market risk are substantially more pronounced for men, which is consistent with them contributing the larger share of income in most families. Increases in emotional loneliness, measured using the de Jong-Gierveld scale, are associated with drops in mental health for both genders, but more so for women (this is consistent with results in Etheridge and Spantig, 2020).

The hump-shape of the MHI-5 evolution over the March-December period is more pronounced for parents. This is consistent with the onset of the spring lockdown being a particularly stressful

period for them, as they had to cope with closed schools and daycare facilities from one day to the next while managing their usual work simultaneously. At the same time, one may expect that over the summer, they were affected less by the restrictions that still were present on many leisure activities and long-distance travel.

Among parents, there are important differences by gender and by how the extra care duties created by the closures of schools and daycare facilities are met. If parents shared the latter, the initial drop was small if present at all; MHI-5 scores are substantially higher over the summer of 2020 than in November 2019. In contrast, if only one parent shouldered the additional childcare, that parent has consistently lower scores over the year. The drop in March was particularly pronounced for fathers who take on the additional duties themselves. Investigating these patterns further, we show that the effects of caregiver duties are strongest for fathers who work many hours from home. Finally, we exploit time use data from November 2019 and April 2020, which contain a direct measure of the number of hours worked from home while being responsible for children at the same time. There are strong gender differences: Mental health is hump-shaped in such hours for men and U-shaped for women. The respective peak/trough is found around 15-20 such hours. These different patterns are consistent with the fraction of total working hours spent simultaneously on childcare and work. Since men work longer hours, men still have plenty of time to get some work done if they spend 15-20 hours taking care of children, too. For women, this is much less the case. Altogether, our results are consistent with a "mom is never off duty when home"-effect.

In the next section, we describe the Dutch setting, our data, and we describe the evolution of mental health and the important covariates over the period from late 2019 and throughout 2020. We then present the results of our various fixed effects regressions, relegating a discussion to the last part of the paper, where we also draw conclusions.

2   Context, data, and stylized facts

In this section, we outline the setting for our analysis. We first describe the institutional context in the Netherlands, putting particular emphasis on the temporal evolution of social distancing policies enacted to reduce the spread of SARS-CoV-2. Following that, we provide an overview of the dataset we collected. We then describe the evolution of mental health and the key explanatory variables

from late 2019 through the year 2020.

2.1 The CoViD-19 pandemic and social distancing policies in the Netherlands

The first SARS-CoV-2 infection was detected in the Netherlands in late February 2020. By mid-March, more than 10 new cases per million inhabitants were confirmed each day (all infection number are based on Roser et al., 2020, Figure E.1 in the Online Appendix shows their evolution along with a stringency index regarding non-pharmaceutical interventions). Despite limited testing, this number had reached 60 by the end of March and stayed roughly at that level for the first three weeks of April. It declined thereafter and reached 10 again in mid-May, staying there or somewhat below until late July 2020. Infection rates started to rise again in August. By mid-September, they had surpassed the peak of the first wave and in late October, they hit almost 600 new daily cases per million inhabitants. During November, this number decreased to a value below 300 but steeply rose again and peaked just below 700 before Christmas.

Similar to other countries, the initial rise in infections prompted the Dutch government to impose restrictions on economic and social life to slow down the virus' spread. In mid-March, all schools and childcare facilities were closed along with restaurants, cafes, bars, and other businesses involving personal contacts. People were advised to stay at home, to keep a distance of at least 1.5 meters to each other, and to avoid social contacts; the number of visitors at home was restricted to a maximum of three individuals.

While most of these policy measures resembled those in other European countries, they did not involve a general curfew and some measures were much more lenient. Businesses, such as stores for clothes, utilities, or coffee shops remained open as long as they could guarantee to maintain the social distancing rules. The government advised everybody to stay at home, but people were allowed to go outside without any official permission, and they were allowed to meet a maximum of three other non-household members as long as social distancing was maintained. Public locations were still accessible and traveling or the use of public transportation was possible throughout. Beginning in May, the restrictions were gradually lifted. Daycare facilities and primary schools were among the first areas to open up again, secondary schools followed in early June. With the exception of bans of larger (inside) gatherings, social and economic life was largely back to what it was before the pandemic.

In mid-October, the Dutch government imposed another lockdown in response to the steep rise in infection numbers. Many of the restrictions were stricter than those imposed in March 2020: Besides the closure of restaurants, bars, museums, and other public places, opening hours for shops were limited and the sale of alcohol was prohibited after 8 p.m.. An important difference was that schools and daycare centers remained open. Along with a temporary sharpening of the measures in early November, this brought infection rates down for some time. However, their rise during the first half of December prompted a great tightening effective from December 15. All shops except supermarkets and essential services were closed along with childcare facilities and schools.

2.2 Data and sample construction

Our empirical analysis uses the Longitudinal Internet Studies for the Social Sciences (LISS), which is a high-quality panel data set based on a probability sample of the Dutch population. The LISS panel has been running since 2007 and comprises roughly 7,000 individuals from about 4,000 households. Each month, respondents are invited to complete questionnaires lasting 15-30 minutes on average. The information solicited from respondents includes a set of ten core questionnaires repeated every year and questionnaires designed by external researchers.

Our baseline measure of mental health stems from the core questionnaire on health administered in November 2019. We included the same measure in a set of modules that we designed to track the consequences of the pandemic (Gaudecker et al., 2020a). In these questionnaires, we asked about mental health, labor market outcomes, and expectations during the CoViD-19 crisis. The initial module was fielded in late March 2020, a few days into the first lockdown. Five more modules followed in April, May, June, September, and December. All CoViD-19 survey modules were addressed to all panel members aged 16 years and older; response rates exceeded 80% in all waves.

The basic structure of our data is an individual-level panel with up to six time series observations.[1] We make the following restrictions on our sample. We keep household heads and their partners for whom we have at least two observations. We restrict the sample to individuals up to age 70 who reported to be employed or self-employed just before the pandemic started while work-

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[1]Because of the short time span between the initial wave in late March and the second wave in April, we did not ask about mental health in April.

ing positive hours. Key explanatory variables are family structures and caregiver arrangements, which we elicit in March and April 2020 and require to be present. Our resulting sample consists of 10,525 observations of 2,353 individuals; 1,138 men and 1,215 women.

2.3 Mental health and family structure

The core LISS questionnaire on health contains the MHI-5 (Mental Health Inventory 5) measure, which is a brief, validated international instrument for assessing mental health in adults (see, e.g., Berwick et al., 1991; Thorsen et al., 2013). We included this measure in our CoViD-19 surveys, too. MHI-5 is a five-item subscale of the Short Format 36 (SF-36), a comprehensive tool to measure the prevalence of depression. Hoeymans et al. (2004) compare the MHI-5 measure to the General Health Questionnaire (GHQ-12) for the Dutch population. They find both measures to be similarly predictive for mental health problems.

The MHI-5 instrument consists of five separate questions to assess how people felt in the past four weeks (see Online Appendix A for details). Each answer comes on a six-point scale. To obtain the MHI-5 score, all answers are coded on scales from zero to five such that higher values indicate better health. Individual values are summed up and multiplied by four. The resulting MHI-5 score ranges from zero to 100, with zero representing very poor mental health and 100 representing its best possible level. Medical literature generally uses cutoffs between 52 and 76 to dichotomize the measure (e.g., Cuijpers et al., 2009; Hoeymans et al., 2004; Thorsen et al., 2013). Values below the cutoff are interpreted as indicative of mental health problems. Probably the most common cutoff is 60, which is also used by official statistics (Statistics Netherlands, 2015). In our analyses, we use the raw score in order to work with a near-continuous measure; averages are typically in the 65-80 range. Our measure is meaningful in the sense that it is indicative of variation in this critical range (as opposed to measuring changes between nearly optimal and optimal; or close to zero and zero).

Panel (a) of Figure 1 displays the evolution of the MHI-5 score across time and gender for the working population. At any point in time, men exhibit higher mental health scores than women. By far the lowest value of mental health is recorded during the first two weeks of the lockdown in March 2020. Relative to November 2019, there is a drop of about 5 points. Already in May, average mental health was close to its initial value and surpassed that over the summer, dropping again in December. Except for the March-May period, the overall pattern is consistent with a

hump-shape over the calendar year, which is found in studies on the seasonality of mental health (see, e.g., Magnusson, 2000, for an overview). The salient feature thus is a transitory shock upon the introduction of the first lockdown, which brought with it lots of uncertainty in many dimensions and dramatic changes in daily living arrangements.

centers may put parents at particular risk for developing mental health problems. We expect this to differ by how partners share the additional burden of taking care of their children during the time where they would usually be in school or daycare. We asked for these arrangements in March and April 2020 if a child below the age of 12 was present in the household, which is the case for a little less than a quarter of our sample (see Panel A in Table 1). For these households, we distinguish between sharing the additional duties (the most common arrangement), taking it on oneself, the partner taking it on, and making use of other arrangements (emergency care for essential workers, grandparents, etc.). For the precise construction of these variables, see Online Appendix B. The last three household categories are single parents, parents of adolescents, and households without underage children.
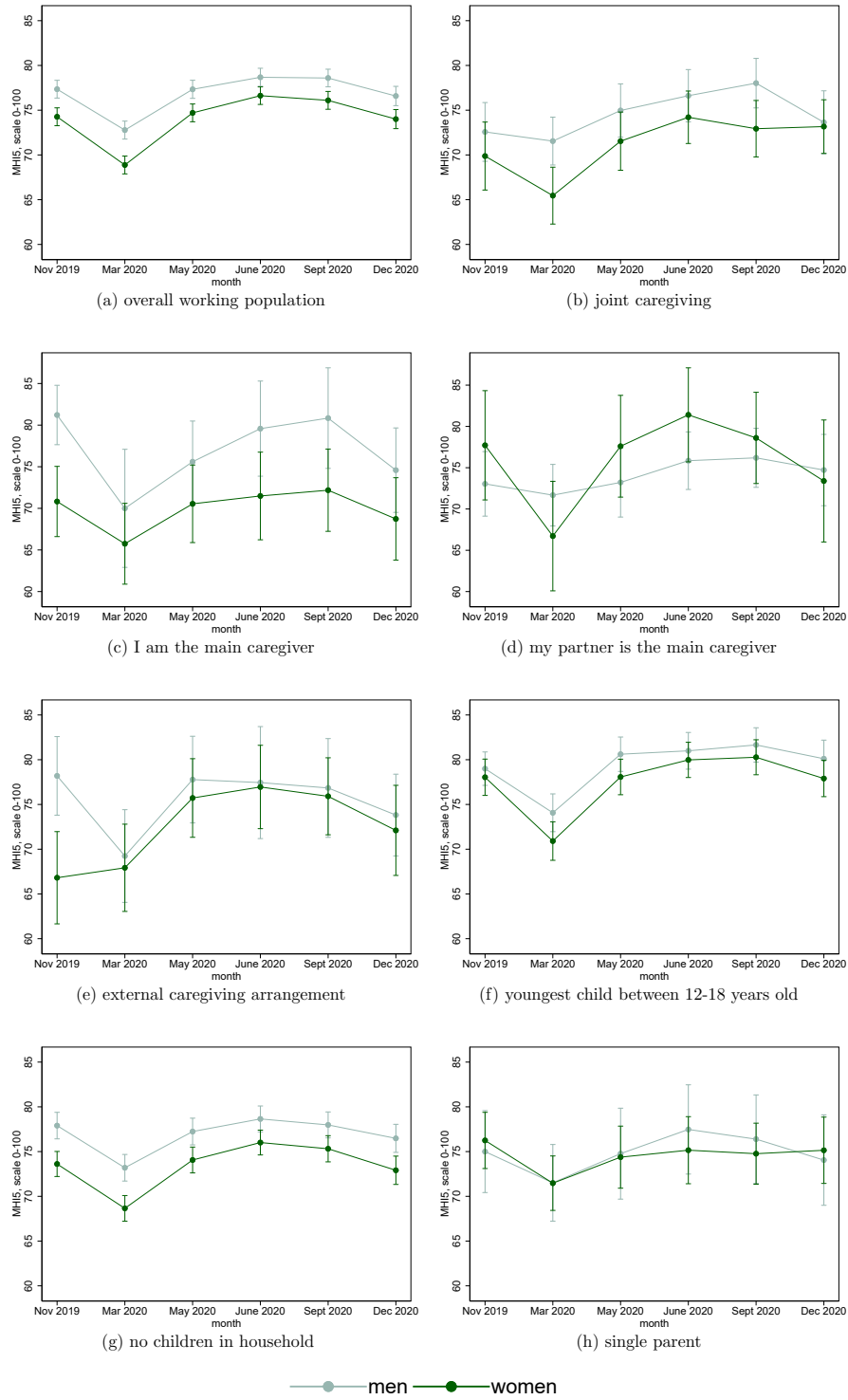
The remaining panels of Figure 1 break down the evolution of the MHI-5 score by these household structures and arrangements regarding the extra childcare. There are important differences across these categories and gender; we focus on the most salient features. Generally, the hump-shape is more pronounced for two-parent families with small children than for the remaining population. There are some exceptions and particularly salient patterns. If partners share the additional responsibilities (Figure 1b), there hardly is a drop in the MHI-5 score for men at the beginning of the first lockdown. The same decline is largest for both genders if fathers are responsible for the additional caregiving duties (Figures 1c for men and 1d for women); in both cases, the recovery is equally steep. Our analysis in Section 3 will separate these patterns from other channels.

2.4 Evolution of key explanatory variables

As described in the introduction, we expect that the pandemic-driven health risk, labor market risk, and emotional loneliness will be predictors of mental health in addition to household structure and childcare arrangements. Panel B. of Table 1 presents the evolution of the remaining explanatory variables across time and gender.

We set perceived infection risk to zero for November 2019, when CoViD-19 was not known

Figure 1: Evolution of mental health by family structure and arrangements made for additional childcare duties during school/daycare closures

(a) overall working population

(b) joint caregiving

(c) I am the main caregiver

(d) my partner is the main caregiver

(e) external caregiving arrangement

(f) youngest child between 12-18 years old

(g) no children in household

(h) single parent

men   women

Note: Each panel shows this evolution separately for men (light) and women (dark). Means are estimated on the sample of the working population and conditional on the primary form of care arrangement and family structure as stated in March or April 2020. Vertical bars depict 95-% confidence intervals.)

Table 1: Summary statistics for the key explanatory variables

A. Household structure / arrangements for extra childcare (measured in March/April 2020)

	child below age 12				child aged 12-18	no child in house-hold	single parent
	jointly	myself	partner	other ar-rangement			
men	0.11	0.02	0.07	0.04	0.23	0.48	0.05
women	0.09	0.05	0.02	0.05	0.22	0.48	0.09

B. Time-varying measurements

	Nov '19	Mar '20	May '20	June '20	Sept '20	Dec '20	overall
Perceived CoViD-19 infection risk							
men	0	0.48	0.30	0.25	0.30	0.33	0.28
women	0	0.48	0.33	0.28	0.36	0.40	0.32
Labor market outcomes and expectations							
reduction working hours > 25%							
men	0	0.15	0.22	0.19	0.20	0.16	0.15
women	0	0.24	0.30	0.24	0.22	0.19	0.20
subjective probability of job loss							
men	0.016	0.037	0.032	0.028	0.024	0.026	0.028
women	0.015	0.043	0.024	0.023	0.025	0.016	0.025
Number of observations							
men	846	1020	849	808	840	812	5,175
women	874	1088	884	828	878	798	5,350

Note: The information on household structure / caregiver arrangements in Panel A is available for 1,138 men and 1,215 women. The exact wording of all questions used to collect the variables in the table can be found in Online Appendix B. Further explanatory variables, such as age and education levels, are presented in the Online Appendix, Table D.1.

yet. The initial uncertainty surrounding the disease in March 2020 is reflected in a very high perceived chance of contracting the disease. Thereafter, perceived risk tracks infection rates in the Netherlands. At 25-40%, the probabilities seem fairly large throughout, likely reflecting a well-known bias towards 50% (e.g., Wakker, 2010). From May onwards, women always perceive a higher chance of being infected with SARS-CoV-2.

The share of people whose working hours are reduced by at least 25% relative to their respective baseline is 15% for men and 24% for women in March. This share reaches its maximum towards the end of the first lockdown in May (22% and 30% respectively). For men, it remains higher than the initial response throughout the year. By contrast, for women, it falls below the March value in the second half of 2020, but the level remains higher than for men. Subjective job loss probabilities follow a different pattern. For both genders, there is a large peak in March 2020, before gradually falling off over the rest of the year. This temporal variation is substantially more pronounced for

women, who have a significantly higher value than men only in March. In December, their perceived probabilities are one percentage point lower than men's. On average, job loss probabilities seem well aligned with actual changes in employment. E.g., the rates of unemployment and of non-participation in the labor force rose by one percentage point each over the course of 2020 (e.g. Gaudecker et al., 2020b; Meekes et al., 2020).

At baseline and in April and June, we have measures for the de Jong-Gierveld Loneliness Scale (Gierveld and Tilburg, 2006), which ranges from 0 to 12 with higher values indicating stronger emotional loneliness. We extrapolate to the remaining periods.[2] Men and women have similar scores just below 1.9 in November 2019 and just above that value in June 2020 (see Table D.2). For both genders, there is a substantial increase during the first lockdown, which is more pronounced for women (2.3) than for men (2.1).

3 Results

The previous section has shown that the potential channels mediating the direct and indirect impact of the pandemic on mental health follow distinct patterns over time and across genders. We now explore individual trajectories in order to judge these channels' relative importance, before zooming in on additional childcare duties in Section 3.2. Our main specification is a fixed effects regression, which we estimate separately for men and women.[3] To allow the effects of household structure and caregiver arrangements—which we measure in March or April 2020—to vary over time, we include interactions with survey month fixed effects. We cluster standard errors at the level of the individual. The reference category for the caregiver/ household type variable is the joint organization of childcare. The reference period is November 2019.

3.1 Predictors of mental health during the CoViD-19 pandemic

Table 2 presents the estimation results of our main specification for men and women. Because the interaction of time and caregiver / household structure variables leads to a large number of coefficients, we only present those for parents of young children in the main text.

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[2]This will be less of an issue once the 2020 LISS core health questionnaire, fielded in November, will be available.

[3]See Section C in the Online Appendix for a formal exposition.

Table 2: Predictors of mental health in the November 2019–December 2020 period

	men	women
prob: becoming infected	-1.48	-2.12**
	(0.91)	(1.00)
reduced working hours: yes	-1.19***	-0.66
	(0.43)	(0.43)
prob: becoming unemployed	-9.62***	-3.16
	(2.01)	(2.14)
loneliness	-0.41***	-1.01***
	(0.15)	(0.17)
March 2020 (reference: sharing extra childcare duties)	-0.41	-1.37
	(1.52)	(1.99)
May 2020 (reference: sharing extra childcare duties)	3.06**	4.42***
	(1.35)	(1.52)
June 2020 (reference: sharing extra childcare duties)	4.21***	5.93***
	(1.26)	(1.85)
September 2020 (reference: sharing extra childcare duties)	5.25***	5.78***
	(1.35)	(1.69)
December 2020 (reference: sharing extra childcare duties)	0.44	3.02
	(1.43)	(1.87)
extra childcare: myself x March 2020	-8.88***	-2.17
	(3.16)	(3.03)
extra childcare: myself x May 2020	-7.55***	-4.37*
	(2.58)	(2.24)
extra childcare: myself x June 2020	-5.38*	-4.69
	(2.85)	(2.93)
extra childcare: myself x September 2020	-4.09	-4.70
	(2.69)	(3.00)
extra childcare: myself x December 2020	-6.10**	-5.43*
	(2.72)	(3.16)
extra childcare: partner x March 2020	0.48	-3.44
	(2.37)	(4.02)
extra childcare: partner x May 2020	-2.01	-2.02
	(2.03)	(3.27)
extra childcare: partner x June 2020	-1.12	-0.15
	(2.22)	(3.54)
extra childcare: partner x September 2020	-1.34	-1.97
	(1.94)	(3.80)
extra childcare: partner x December 2020	1.97	-3.54
	(2.23)	(3.56)
extra childcare: other arrangement x March 2020	-8.03***	1.90
	(2.84)	(3.78)
extra childcare: other arrangement x May 2020	-1.57	4.16
	(2.53)	(3.34)
extra childcare: other arrangement x June 2020	-3.49	3.44
	(2.99)	(3.21)
extra childcare: other arrangement x September 2020	-5.70**	3.98
	(2.65)	(3.27)
extra childcare: other arrangement x December 2020	-2.34	2.07
	(2.72)	(3.85)
observations	5,175	5,350
number of individuals	1,138	1,215
individual specific FE	yes	yes

*** $p<0.01$, ** $p<0.05$, * $p<0.1$; standard errors clustered on the individual level. The table presents the estimated coefficients of the main channels on mental health obtained from Equation (C.1). We control for a full set of interactions between survey month and categories of caregiver arrangements and household structure. The reference period is November 2019, the reference category are parents who share the extra childcare that becomes necessary during the closure of school and daycare centers. To economize on space, we do not report all regression coefficients; the full set of results can be found in the Online Appendix, Table D.3.

Labor market uncertainty has a much stronger effect for men than for women. A reduction in working hours of at least 25% relative to the working hours in the pre-crisis period leads to a significant reduction in men's mental health score by 1.2 points. An effect of similar magnitude obtains for a ten percentage point increase in the probability to lose one's job. For women, the point estimates are considerably smaller; the difference between genders is statistically significant for perceived unemployment risk. It is well-known from earlier work that recessions negatively impact mental health (e.g. Frasquilho et al., 2016; McInerney et al., 2013). Because for most Dutch households, male earnings play a substantially larger role in total household income than female earnings, the gender differences do not come as a surprise.

Men and women experience a reduction in mental health as their emotional loneliness increases. For men, an increase in the loneliness score by 1 point leads to a decrease in the MHI-5 score of 0.4 points. The same reaction is 1 point for women; the difference between genders is significant. Given that the scale varies from 0 to 12, these are large effects; due to the measurement error induced by extrapolation, we expect them to be a lower bound. The gender differences mirror findings for the U.K. reported in Etheridge and Spantig (2020).

The coefficients on the survey month fixed effects show the development of mental health for parents who jointly organize the additional childcare duties caused by the school closures during the first lockdown. After controlling for covariates, the average drop in March is small and insignificant for both genders. For the May-September period, MHI-5 scores are substantially higher compared to November 2019, before falling again. These estimates by and large confirm the patterns outlined in Figure 1.

Relative to this trajectory, parents who were solely responsible for taking on the additional childcare duties experience substantially larger reductions in mental health throughout 2020. The pattern is more pronounced among men, where the average drop in the MHI-5 score between November 2019 and March 2020 is around 9 points. The recovery from this shock is slow and significantly worse than for fathers who share caregiver duties with their partners. For women, the initial shock is much smaller; patterns look similar to men from June onward. These coefficients suggest a substantial burden on the mental health of parents in couples where additional childcare is not shared.[4] In December 2020, MHI-5 scores are significantly below their pre-pandemic values.

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[4]Unfortunately, the small sample size prevents us to investigate further whether this is a pure choice or due to

As may be expected from Figure 1d, there hardly is a change in men's mental health if their partner has compensated for school and daycare closures. Coefficients are small and insignificant, always working against the hump-shaped pattern. For women whose partner is mainly responsible for additional childcare duties, controlling for covariates cuts the drop upon the onset of the pandemic in Figure 1d by more than half and renders it insignificant. All estimated coefficients are negative and insignificant.

Summing up, our results show that the patterns from Figure 1 for differences by caregiver arrangement are broadly confirmed in the fixed effects analysis. Moreover, exposure to infection risk and emotional loneliness channel predicts deterioration in mental health among both genders of similar magnitude. For loneliness, the reaction is somewhat stronger among women. By contrast, for men, the pandemic significantly operates through labor market channels. This seems plausible since men are frequently the main breadwinner, implying that the prospect of losing their job may generate more anxiety.

3.2 A double burden of home office and childcare duties?

The results from our main specification have revealed that men who were mainly responsible to handle additional childcare duties experienced the largest initial reduction in mental health, more than women in the same category and also more than fathers with other types of childcare arrangements. One reason behind this might be that the primary reason for men to exclusively take on the extra childcare is that they can work from home whereas their partners cannot. Indeed, among families with fathers being the main caregiver, they work more than 20 hours from home whereas mothers' home office hours are below 4. As there are no reductions in working hours for parents of underage children relative to the remaining population (Holler et al., 2021), these men would be faced with the task of working and taking care of their children at the same time.

To shed light on this channel, Table 3 reports the results of fixed effects regressions that include an interaction of home office hours and the extra caregiver/household structure variable. Panel A shows the most important results for the full set of time periods; Panel B focuses on the comparison between November 2019 and the first lockdown period, which included closed schools and daycare.

Among the reference group—couples sharing the extra childcare burden—an additional hour of

more exogenous factors like work schedules of essential workers early in the pandemic.

Table 3: Effect of hours worked from home by arrangement for extra childcare duties on mental health

	men	women
A. all periods		
hours worked from home (reference: sharing extra childcare duties)	-0.02	-0.01
	(0.04)	(0.05)
extra childcare: myself x hours worked from home	-0.18***	-0.10
	(0.06)	(0.11)
extra childcare: partner x hours worked from home	-0.01	-0.33**
	(0.06)	(0.13)
extra childcare: other arrangement x hours worked from home	0.09	0.16
	(0.09)	(0.12)
observations	5,175	5,350
number of individuals	1,138	1,215
individual specific FE	yes	yes
survey month fixed effects	yes	yes
B. during lockdown of schools/childcare		
hours worked from home (reference: sharing extra childcare duties)	-0.01	-0.10
	(0.05)	(0.08)
extra childcare: myself x hours worked from home	-0.17*	-0.09
	(0.09)	(0.14)
extra childcare: partner x hours worked from home	-0.08	-0.70***
	(0.10)	(0.21)
extra childcare: other arrangement x hours worked from home	-0.03	0.44**
	(0.13)	(0.18)
observations	2,715	2,846
number of individuals	1,133	1,212
individual specific FE	yes	yes
survey month fixed effects	yes	yes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors clustered on the individual level; The table presents the estimation results of home office hours by extra childcare duties on mental health for the working population from equation C.2 separately for men and women. Panel A shows the regression results for the working population in all survey waves from November 2019 to December 2020. Panel B shows the regression results when we restrict our results to November 2019 and the period of the first lockdown, which included closed schools and daycare centers, from March to May 2020. The baseline period: November 2019. The table only presents the coefficients on home office working hours and interactions between home office working hours and the set of childcare arrangements for children under 12 years of age. The full set of interactions, infection risk, labor market channel and social interaction channel is shown in the Online Appendix, Table D.5.

working from home does not significantly reduce mental health. For both genders, the coefficients are close to zero and precisely estimated. When fathers take over the main caregiver responsibility, an extra hour worked from home hour leads to a reduction of 0.17-0.18 points in the MHI-5 score. On average, these fathers work about 20 hours from home, so their mental health is reduced by about 3.5 points more than for similar men in couples who share the additional responsibilities. The point estimate for women is smaller but imprecisely estimated.

No differential effect of home office hours is visible for fathers whose partner takes the main responsibility for additional childcare. By contrast, women experience a large and significant decrease in mental health as home office hours increase; the effect is substantially larger when concentrating

on the initial lockdown period in Panel B. Together with the findings in Figure 1d and Table 2, this coefficient suggests that women are particularly at risk for developing mental health problems in situations where partners are supposed to take care of the children while they work from home. Complementary to this, women's mental health develops significantly better during the first lockdown period if they are working long hours from home. This effect washes out when considering our entire study period.

Finally, we take another look from a different angle using a direct measure for hours worked from home while being responsible for childcare at the same time. The measure is included in a time use survey. The survey is comparable to a similar one from November 2019 but adapted to the lockdown situation (see Gaudecker et al., 2020a, for the precise wording of the questions). Time use refers to the past week; this week falls into the four-week assessment period for mental health in the November and May questionnaires, respectively.
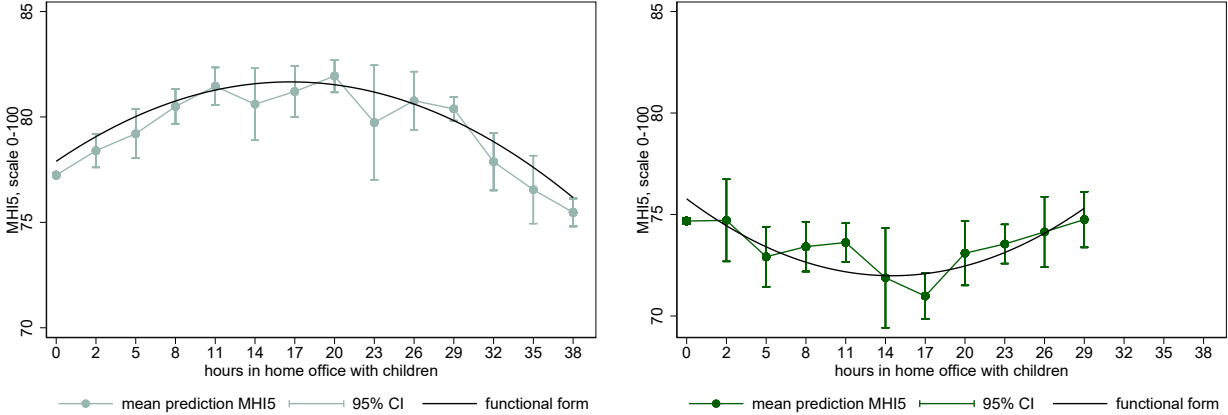

Figure 2: Predicted mental health score by hours worked from home while simultaneously taking care of children

The figure plots predicted mental health against hours in home office while taking care of children. Predicted values are obtained from an OLS regression with individual-specific fixed effects of mental health on a quadratic in hours worked from home while being responsible for children at the same time. The estimation is based on a sample of 1,035 men and 1,091 women who participated in the survey in November 2019 and May 2020. We control for measures of labor market risk, infection risk, and social interaction channels, and survey month fixed effects. The estimated coefficients from the quadratic specification can be found in the Online Appendix, Table D.6. We use the average of fixed effects to adjust the level of mental health based on the quadratic function to those in the data. The predicted values use bins of three hours.

Figure 2 shows predicted mental health scores from a fixed effects regression of mental health on a quadratic function in hours worked from home while being responsible for childcare at the same time. The regression specification also includes the remaining three channels and survey month

fixed effects. We plot up to the 99th percentile of the distribution of hours worked from home with kids present, which is 40 hours for men and 30 hours for women. For men, we find a hump-shaped relationship between mental health and home office hours, which reaches its maximum around 18 and its minimum in the right tail of the distribution. For women the pattern looks opposite, suggesting that women who work around 15 hours from home and take care of their children at the same time have the lowest mental health score.

Importantly, there are no systematic differences in November 2019—neither in mental health nor working hours—along the distribution of hours worked from home with kids. In particular, in November 2019, mental health is about the same whether or not somebody reports positive home office hours with children in April 2020. The patterns thus do not seem to be driven by selection or regression to the mean. Furthermore, total working hours in April do not have a clear relationship with the amount of home office hours with children. To be precise, holding the ability to work from home constant by conditioning on positive hours worked from home, there is no difference between parents who mind their children at the same time and workers who never do so.[5]

4   Discussion and conclusions

We have analyzed how changes in the mental health of a representative sample of the Dutch working population evolved from before the CoViD-19 pandemic through its first year. Upon the onset of the first lockdown, amidst a period of high uncertainty in many dimensions, mental health dropped very sharply. It recovered over the summer before dropping slightly again, so that December 2020 values are comparable to those from November 2019. Investigating the joint evolution with several potential mediators identified in the literature—household structure and arrangements for taking care of children during the period of school closures, SARS-CoV-2 infection risk, employment prospects, and lack of social interactions—we document substantial heterogeneity.

Mental health falls in perceived infection risk, maybe more so for women. On the other hand, the effects of labor market risk are substantially more pronounced for men, which is consistent with

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[5]Among all mothers working from home, those who also take care of their children work on average 31.3 hours in total. Women who do not mind their children at the same time work 31.2 hours. Fathers in home office work on average 40.1 hours when not taking care of their children at the same time compared to 36.8 hours when also taking care of children. These differences in working hours are about the same for mothers (30.1 vs 31.2) and fathers (41.8 vs 36.8) in November 2019.

them contributing the larger share of income in most families. Increases in emotional loneliness are associated with drops in mental health for both genders, but more so for women (this is consistent with results in Etheridge and Spantig, 2020).

The hump-shape of the MHI-5 evolution over the March-December period is more pronounced for parents. The onset of the spring lockdown was a particularly stressful period for them. They had to cope with closed schools and daycare facilities from one day to the next while managing their usual work at the same time. We do not find clear gender effects and in fact, some of the largest drops are found for fathers when they are solely responsible for the additional childcare. In contrast to this, much of the international literature has found larger effects for women. However, these studies often lack pre-pandemic measures of mental health. Thus, the estimated effect may capture potential level differences in mental health between men and women rather than the additional effect of the pandemic on mental health (e.g. Adams-Prassl et al., 2020; Zamarro and Prados, 2021). A notable exception is Etheridge and Spantig (2020), which finds that mothers with substantial child care duties are particularly affected in terms of psychological distress during the first wave of the pandemic in the UK. While not directly comparable, our results for the Netherlands generally go in a different direction. This likely has to do with a very high share of part-time work among women (more than 60% worked less than 30 hours per week in 2017, see OECD, 2018) and very flexible work arrangements, which are mandated by a 2016 law. In general, our results paint a nuanced picture of the effects of the pandemic in two-parent families, which depend on the degree the extra burden during school and daycare closures is shared between partners and on the fraction of working time that is performed from home while simultaneously being responsible for children.

Taken together, our results are consistent with literature showing large but transitory impacts of negative aggregate shocks on mental well-being. For example, Deaton (2012) finds a large impact of the Great Recession in late 2008 and early 2009. These values subsequently recovered despite the fact that unemployment remained high. During the CoViD-19 pandemic in the Netherlands, mental health indicators substantially improved for parents after the period when schools were closed. Despite a second lockdown in December, mental health in the working population was similar to that before the pandemic. Our results are best explained by short-run anxiety associated with a novel and negative situation characterized by uncertainty and quick subsequent adoption.

18

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